

Section 454

1 The contract unit price for *CIP Gravity Retaining Walls* does not include the cost for ditches,
2 fences, handrails, guardrail or barriers associated with CIP gravity walls as these items will be
3 paid for elsewhere in the contract.

4 Where it is necessary to provide backfill material from sources other than excavated areas or
5 borrow sources used in connection with other work in the contract, payment for furnishing and
6 hauling such backfill material will be paid as extra work in accordance with Article 104-7.
7 Placing and compacting such backfill material is not considered extra work but is incidental to
8 the work being performed.

9 Payment will be made under:

Pay Item	Pay Unit
CIP Gravity Retaining Walls	Square Foot

SECTION 454

SEGMENTAL GRAVITY RETAINING WALLS

454-1 DESCRIPTION

13 Construct segmental gravity retaining walls consisting of segmental retaining wall (SRW) units
14 supported by aggregate footings. Provide CIP concrete slope protection as required. Design,
15 if required, and construct segmental gravity retaining walls based on actual elevations, wall
16 dimensions and batter in accordance with the contract, accepted submittals and if included in
17 the plans, standard segmental gravity wall detail.

18 Define “block wall” as a segmental gravity retaining wall and “standard block wall” as a block
19 wall that meets the standard segmental gravity retaining wall details. Define “blocks” as SRW
20 units, “cap blocks” as SRW cap units and “Block Vendor” as the vendor licensing the block
21 producer. Define “slope protection” as CIP concrete slope protection.

454-2 MATERIALS

23 Refer to Division 10.

Item	Section
Geotextiles, Type 2	1056
Joint Materials	1028
Portland Cement Concrete, Class B	1000
Segmental Retaining Wall Units	1040-4
Select Material	1016
Subsurface Drainage Materials	815-2

24 Provide Type 2 geotextile for separation geotextiles. Use Class VI select material for No. 57
25 stone and Class B concrete for slope protection. Provide PVC pipes, fittings, outlet pipes and
26 concrete pads for subsurface drainage materials. For PVC pipes behind block walls, use pipes
27 with perforations that meet AASHTO M 278.

28 Provide cap blocks that meet the material requirements for blocks. Use blocks from producers
29 approved by the Department and licensed by the Block Vendor. Notify the Engineer of the
30 name and NCDOT ID number of the SRW unit production facility before beginning block
31 production. Provide blocks with a depth (front to back) of at least 12 inches and cap blocks
32 with a depth of at least 8 inches.

33 Use approved SRW units for standard block walls. Blocks for standard block walls are
34 approved for either 2 foot or 4 foot maximum design heights with the design height as shown
35 in the standard segmental gravity wall details. The list of approved SRW units with maximum
36 design heights is available from the Geotechnical web site.

37 Do not mix blocks from different Block Vendors on the same block wall. Damaged blocks
38 with excessive discoloration, chips or cracks as determined by the Engineer will be rejected.

1 Provide adhesives recommended by the Block Vendor. Store adhesives in accordance with the
2 manufacturer's instructions. Load, transport, unload and store block wall materials so materials
3 are kept clean and free of damage.

4 **454-3 PRECONSTRUCTION REQUIREMENTS**

5 **(A) Block Wall Surveys**

6 The plans typically show a plan view, typical sections, details, notes and an elevation or profile
7 view (wall envelope) for each block wall. Before beginning block wall design or construction,
8 survey existing ground elevations along wall face locations and other elevations in the vicinity
9 of block wall locations as needed. For proposed slopes above or below block walls, survey
10 existing ground elevations to at least 10 feet beyond slope stake points. Based on these
11 elevations, finished grades and actual block wall dimensions, details and batter, submit wall
12 envelopes for acceptance. Use accepted wall envelopes for design, if required, and
13 construction.

14 **(B) Block Wall Designs**

15 If the plans do not include standard segmental gravity wall details, submit design calculations
16 and working drawings for block wall designs at least 30 days before starting block wall
17 construction. Do not begin block wall construction until a design submittal is accepted.

18 Design block walls in accordance with the plans and Article 11.11 of the AASHTO LRFD
19 Bridge Design Specifications unless otherwise required. Neglect material above top of footing
20 for stability computations. Design block walls for the wall batter required by the Block Vendor
21 and clearances shown in the plans. Do not locate blocks or footings outside right-of-way or
22 easement limits.

23 Use No. 57 stone for aggregate footings beneath blocks. Use 10 inch thick footings that are
24 continuous at steps and extend at least 6 inches in front of and at least 9 inches behind bottom
25 row of blocks. Embed bottom of footings at least 18 inches below bottom of walls shown in
26 the plans. When noted in the plans, locate a 4 inch diameter continuous perforated PVC drain
27 pipe in the No. 57 stone in back of footings.

28 Fill block core spaces with No. 57 stone and between and behind blocks with No. 57 stone for
29 a horizontal distance of at least 12 inches so stone is continuous in all directions. Assume a
30 unit weight of 100 lb/cf for No. 57 stone. Separation geotextiles are required between No. 57
31 stone and backfill or natural ground, and between stone and overlying fill or pavement section
32 except when concrete pavement, full depth asphalt or cement treated base is placed directly on
33 stone.

34 Use cap blocks at top of walls. Step top of walls as shown in the plans and double stack cap
35 blocks at steps so cap blocks are continuous at steps. Extend top of walls 4 inches to 12 inches
36 above where finished grade intersects back of blocks or cap blocks. When single faced precast
37 concrete barrier is required in front of and against block walls, fill voids between barrier and
38 wall faces with Class V select material.

39 Submit working drawings and design calculations for acceptance in accordance with Article
40 105-2. Submit working drawings showing plan views, wall profiles with required resistances,
41 typical sections, No. 57 stone and geotextile locations and details of footings, blocks, cap
42 blocks, etc. If necessary, include details on working drawings for slope protection and
43 obstructions extending through walls or interfering with footings. Submit design calculations
44 for each wall section with different geometry or material parameters. When designing block
45 walls with computer software, a hand calculation is required for the tallest wall section. Provide
46 block wall designs sealed by an engineer licensed in the state of North Carolina.

Section 454

1 **454-4 CONSTRUCTION METHODS**

2 Control drainage during construction in the vicinity of block walls. Direct run off away from
3 block walls, No. 57 stone and backfill. Contain and maintain stone and backfill and protect
4 material from erosion.

5 Excavate as necessary for block walls in accordance with the plans and accepted submittals.
6 Notify the Engineer when foundation excavation is complete. Do not place No. 57 stone for
7 footings until excavation dimensions and foundation material are approved.

8 Construct aggregate footings at elevations and with dimensions shown in the plans and accepted
9 submittals. If a drain is required, install wall drainage systems consisting of drains and outlet
10 components as shown in the plans and accepted submittals and in accordance with Section 815.
11 Compact No. 57 stone for footings with a vibratory compactor to the satisfaction of the
12 Engineer.

13 Stack blocks with no negative wall batter (wall face leaning forward) so the final wall position
14 is as shown in the plans and accepted submittals. Place blocks with a maximum vertical joint
15 width of 3/8 inch. Stagger blocks to create a running bond by centering blocks over joints in
16 the row below as shown in the plans and accepted submittals. Construct block walls with the
17 following tolerances:

18 A. Blocks are level from front to back and between units when checked with a 4 foot long
19 level,

20 B. Final wall face is within 2 inches of horizontal and vertical alignment shown in the plans
21 and accepted submittals, and

22 C. Wall batter is within 2 degrees of batter required by the Block Vendor.

23 Overlap adjacent separation geotextiles at least 18 inches at seams and hold geotextiles in place
24 with wire staples or anchor pins as needed. Place No. 57 stone between and behind blocks in
25 8 inch to 10 inch thick lifts. Compact stone with hand operated compaction equipment to the
26 satisfaction of the Engineer. Backfill for block walls behind No. 57 stone in accordance with
27 Article 410-8.

28 Set cap blocks with a 1/2 inch to 1-1/2 inch overhang as shown in the plans and accepted
29 submittals. Place cap blocks using adhesive in accordance with the manufacturer's instructions.
30 Do not place cap blocks if surfaces caps will be attached to are wet or frozen or the air
31 temperature measured at the wall location in the shade away from artificial heat is below 40°F.
32 Before applying adhesive, clean surfaces cap blocks will adhere to and ensure surfaces are dry
33 and free of oil, grease, dust and debris.

34 Pave slopes above and behind block walls with slope protection as shown in the plans and
35 accepted submittals and in accordance with Article 462-3. Construct slope protection joints at
36 a maximum spacing of 10 feet. Make 1/2 inch thick expansion joints that meet Article 420-10
37 for every third joint and 1/2 inch deep grooved contraction joints that meet Subarticle 825-
38 10(B) for the remaining joints.

39 **454-5 MEASUREMENT AND PAYMENT**

40 *Segmental Gravity Retaining Walls* will be measured and paid in square feet. Block walls will
41 be measured as the square feet of wall face area with the pay height equal to the difference
42 between top of wall and top of footing elevations. Define "top of wall" as top of cap blocks.

43 The contract unit price for *Segmental Gravity Retaining Walls* will be full compensation for
44 providing designs, if required, submittals, labor, tools, equipment and block wall materials,
45 excavating, backfilling, hauling and removing excavated materials and supplying footings,
46 blocks, select material, wall drainage systems, geotextiles, cap blocks, slope protection and any
47 incidentals necessary to construct block walls.

1 The contract unit price for *Segmental Gravity Retaining Walls* does not include the cost for
 2 ditches, fences, handrails, guardrail or barriers associated with block walls as these items will
 3 be paid for elsewhere in the contract.

4 Where it is necessary to provide backfill material behind No. 57 stone from sources other than
 5 excavated areas or borrow sources used in connection with other work in the contract, payment
 6 for furnishing and hauling such backfill material will be paid as extra work in accordance with
 7 Article 104-7. Placing and compacting such backfill material is not considered extra work but
 8 is incidental to the work being performed.

9 Payment will be made under:

Pay Item	Pay Unit
Segmental Gravity Retaining Walls	Square Foot

10 **SECTION 455**
 11 **PRECAST GRAVITY RETAINING WALLS**

12 **455-1 DESCRIPTION**

13 Construct precast gravity retaining walls consisting of precast retaining wall (PRW) units
 14 supported by concrete footings. Provide CIP concrete slope protection as required. Design and
 15 construct precast gravity retaining walls based on actual elevations, wall dimensions and batter
 16 in accordance with the contract and accepted submittals. Define “precast gravity wall” as a
 17 precast gravity retaining wall and “PRW Unit Vendor” as the vendor licensing the precaster.
 18 Define “slope protection” as CIP concrete slope protection.

19 **455-2 MATERIALS**

20 Refer to Division 10.

Item	Section
Geotextiles, Type 2	1056
Joint Materials	1028-1
Portland Cement Concrete	1000
Select Material, Class VI	1016
Precast Retaining Wall Units	1077
Subsurface Drainage Materials	815

21 Provide Type 2 geotextile for separation geotextiles. Use Class A concrete for footings, Class
 22 B concrete for slope protection and Class VI select material for No. 57 stone. Provide PVC
 23 pipes, fittings, outlet pipes and concrete pads for subsurface drainage materials. For PVC pipes
 24 behind precast gravity walls, use pipes with perforations that meet AASHTO M 278.

25 Provide PRW cap and top units that meet the material requirements for PRW units. Use PRW
 26 units from producers approved by the Department and licensed by the PRW Unit Vendor.
 27 Produce PRW units with a final finish that meets Article 1077-11 except for unit faces. Provide
 28 PRW units with a vertical rock like face and a concrete gray color with no tints, dyes or
 29 pigments. Do not begin unit production until sample PRW units of the type, face and color
 30 proposed for the project are approved.

31 Do not mix PRW units from different PRW Unit Vendors on the same precast gravity wall.
 32 Damaged PRW units with excessive discoloration, chips or cracks as determined by the
 33 Engineer will be rejected. Load, transport, unload and store precast gravity wall materials so
 34 materials are kept clean and free of damage.